in the past have met with little success, but now a method has been devised and is in use in Germany and Belgium whereby the cement manufactured commands a higher price in the market than ordinary Portland cement.

An apparatus for equalizing the temperature of the hot blasts was described by Mr. L. F. Gjers and Mr. J. H. Harrison. Instead of the blast going directly from the stoves to the tuyers, whereby the temperature falls continuously from the turning on of one stove until a fresh stove is used, the blast passes from the stove through another small stove filled with checker work, and while entering on one side with varying temperature, it leaves the small stove at an even mean temperature.

The affairs of the Institute were shown to be in a very flourishing condition, 110 members being added during the year. The Bessemer gold medal for 1900 was presented to M. Henri de Wendel, the eminent French metallurgist, in recognition of his services to metallurgy in developing the iron ore resources of French and German Lorraine.

Mr. Andrew Carnegie announced his intention of founding a scholarship in connection with the Institute, for the advancement of research in connection with iron and steel.

THE same number of *Nature* gives an account of the Royal Society Converzazione of May 9th, but there appear to have been few exhibits in the line of chemistry. Professor W. A. Shenstone showed a quantity of crude non-splintering silica for use in apparatus of silica, recently described in these NOTES, and also several rods, tubes, a Giessler tube and a mercury thermometer of silica. Dr. Thorpe exhibited some examples of leadless glazed ware, and Mr. H. B. Hartley and Mr. H. L. Bowman gave a demonstration of the properties of crystals yielding double-refracting liquids on fusion. These substances, among which are para-azoxyanisol, para-azoxyphenetol, and cholesteryl benzoate, when fused give liquids which possess the properties of double refraction and dichroism, although the evidence of their elasticity, viscosity, and dielectric capacity shows them to be undoubtedly liquids.

APROPOS of Professor Shenstone's work on fused quartz a paper has appeared in the *Proceedings* of the Royal Dublin Society, by Professor J. Joly, on the 'Theory of the Formation of Silicates in Igneous Rocks,' in which he discusses the temperature range of the viscosity of quartz. He finds that when heated to 800° quartz becomes plastic and that as high as 1500° it is a thick liquid. This softening point is much lower than is commonly supposed, and makes it easier to understand the facility with which it is worked by Professor Shenstone. At the same time it lends more encouragement to the hope of a wide use of quartz for apparatus.

No little comment has been occasioned, especially in England, by the publication in the *Zeitschrift für angewandte Chemie* of a lecture delivered before the German Emperor by Professor Bredt. The title of the lecture was 'Technical Education and the Importance of Scientific Training,' and statistics were given of the three great dye-stuff factories of Germany. From these it appears that the Badische Anilin- und Sodafabrik, of Ludwigshafen, employs 6207 workmen, including 146 chemists and 75 engineers. The Farbewerke vorm. Meister Lucius und Brüning of Höchst am Main and the Farbenfabriken vorm. Fr. Bayer & Co., of Elberfeld, each employ 130 chemists. With these facts before one, it is not difficult to understand that Germany leads the world in dye stuffs.

J. L. H.

NOTES ON PHYSICS.

THE FREEZING POINT OF WATER AND PRESSURE.

IN the *Annalen der Physik* for May, 1900, G. Tammann describes some remarkable experimental studies of the variation of the freezing-point of water with pressure. It appears that that there are three kinds of ice differing from each other in crystalline structure. Counting these three kinds of ice, five forms of water are now known, namely, vapor, liquid, ice I. (common ice), ice II., and ice III. A given pair of these forms (phases) of water can exist together in equilibrium only at definite temperatures and pressures. That is, for a given temperature the pressure at which two phases may coexist is definite. Thus ice I. and water coexist at 0°C. under atmospheric pressure, at —3°.7C. under 500 atmospheres, at — 8°.4C. under 1000

atmospheres, etc. These pairs of temperatures and pressures represented by ordinates and abscissas determine a curve. This curve is called the *transition curve* (umwandlungs curve) for water and ice. Herr Tammann has followed the transition curve for water and ordinary ice far beyond the region previously known, in fact throughout its entire extent, and he has determined portions of the transition curves of water and ice II., of water and ice III., of ice I. and ice II., and of ice I. and ice III. He has also determined the latent heats of fusion of ice II. and of ice III., the latent heats of transition from ice I. to ice II. and from ice I. to ice III., and the changes of volume during these various transitions.

READERS of SCIENCE who are not familiar with recent work in physical chemistry may be interested to know that many solid substances are known which have two or more forms (phases). Thus, very recently, it has been found that metallic tin may exist as a gray crystalline powder or in the well known form having lustre and ductility. At a certain temperature (under atmospheric pressure) these two phases may coexist in equilibrium, at higher temperatures the ductile variety only is stable, and at lower temperatures the gray crystalline form only is stable.

SOME EXPERIMENTS WITH POLARIZED LIGHT.

THE *Annalen der Physik* for May, 1900, contains a description by N. Vmow of several beautiful and instructive experiments with polarized light.

A polished cone of glass stands upon a flat white screen. A beam of ordinary light parallel to the axis of the cone is reflected by the curved surface of the cone forming a circle of light around the base of the cone upon the white screen. If the beam of light is plane polarized the circle of light will have a broad dark streak across it. If a quartz plate is placed in the path of the plane polarized beam the planes of polarization of the various wave-lengths will be differently turned and the circle of light around the base of the cone will consist of radial bands of color in the order red, orange, yellow, green, blue, violet, purple.

A plane polarized beam of light is reflected down through milky water (obtained by mixing a small portion of an alcoholic solution of rosin with the water) contained in a glass cylinder. To a person walking around the cylinder the water would appear bright then dark then bright then dark again. The two opposite directions from which the milky water appears bright mark the plane of polarization of the beam of light. If now a quartz plate is interposed in the path of the polarized beam the planes of polarization of the various wave-lengths will be differently turned and the milky water will appear to be streaked with vertical bands of color. A milky solution of sugar substituted for the water (quartz plate removed) shows a series of helical bands of color.

ON THE SIZE AT WHICH HEAT MOVEMENTS ARE MANIFESTED IN MATTER.

IN his characteristically suggestive way Professor G. F. Fitzgerald, in *Nature*, April 26th, raises the question as to the maximum dimensions of a space in which the heat movements of a portion of a body in thermal equilibrium might deviate sensibly from the steady average which these movements show on a large scale. The heat movements of matter do not show their erratic character in a space large enough to be resolved by the microscope, but Professor Fitzgerald points out that the accompanying ether motions are much more coarse grained and may give rise to sensible phenomena; thus the so-called Brownian motions of small particles immersed in a liquid may be caused by the erratic character of heat motions in small regions. He suggests further that these erratic heat motions may have something to do with the vitality of diatoms. Indeed *it is physically possible* that a living cell may not be subjected to the second law of thermodynamics. If so, in what way would a diatom be expected to show its freedom from this law? Very likely in not being dependent upon food for the maintenance of its vitality, and the biologist may sometime show us an organism which can live in the dark without food.

W. S. F.